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FLOOD INSURANCE STUDY

TOWNSHIP OF GRANT, MICHIGAN

CHEBOYGAN COUNTY

JANUARY 18, 1989

Federal Emergency Management Agency

COMMUNITY NUMBER · 260610

NOTICE TO
FLOOD INSURANCE STUDY USERS

Communities participating in the National Flood Insurance Program have established repositories of flood hazard data for floodplain management and flood insurance purposes. This Flood Insurance Study may not contain all data available within the repository. It is advisable to contact the community repository for any additional data.

TABLE OF CONTENTS

		Page
1.0	INTRODUCTION	1
	1.1 Purpose of Study	1
	1.2 Authority and Acknowledgments	1
	1.3 Coordination	1
2.0	AREA STUDIED	2
	2.1 Scope of Study	2
	2.2 Community Description	2
	2.3 Principal Flood Problems	4
	2.4 Flood Protection Measures	4
3.0	ENGINEERING METHODS	4
	3.1 Hydrologic Analyses	5
	3.2 Hydraulic Analyses	6
4.0	FLOODPLAIN MANAGEMENT APPLICATIONS	6
	4.1 Flood Boundaries	7
	4.2 Floodways	7
5.0	INSURANCE APPLICATION	8
6.0	FLOOD INSURANCE RATE MAP	10
7.0	OTHER STUDIES	10
8.0	LOCATION OF DATA	10
9.0	REFERENCES AND BIBLIOGRAPHY	10

TABLE OF CONTENTS (Continued)

Page

FIGURES

Figure 1 - Vicinity Map 3

Figure 2 - Floodway Schematic 8

TABLES

Table 1 - Summary of Discharges 5

Table 2 - Summary of Elevations 5

Table 3 - Floodway Data 9

EXHIBITS

Flood Profiles

Black River Panels 01P - 03P

Flood Insurance Rate Map Index
Flood Insurance Rate Map

Elevation Reference Marks

FLOOD INSURANCE STUDY

TOWNSHIP OF GRANT,
CHEBOYGAN COUNTY,
MICHIGAN

1.0 INTRODUCTION

1.1 Purpose of Study

This Flood Insurance Study investigates the existence and severity of flood hazards in the Township of Grant, Cheboygan County, Michigan, and aids in the administration of the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973. This study has developed flood risk data for various areas of the community that will be used to establish actuarial flood insurance rates and assist the community in its efforts to promote sound floodplain management. Minimum floodplain management requirements for participation in the National Flood Insurance Program are set forth in the Code of Federal Regulations at 44 CFR, 60.3.

In some states or communities, floodplain management criteria or regulations may exist that are more restrictive or comprehensive than the minimum Federal requirements. In such cases, the more restrictive criteria take precedence and the State (or other jurisdictional agency) will be able to explain them.

1.2 Authority and Acknowledgments

The sources of authority for this Flood Insurance Study are the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973.

The hydrologic and hydraulic analyses for this study were performed by Johnson & Anderson, Inc., (the Study Contractor) for the Federal Emergency Management Agency (FEMA), under Contract No. EMW-84-C-1614. This study was completed in July 1986.

1.3 Coordination

Streams and lakes requiring detailed study were identified at a meeting attended by representatives of the Study Contractor, FEMA, and the Township of Grant in April 1984.

A subsequent meeting was held between the Township Supervisor and the Study Contractor in October 1985, at which time specific areas of existing and potential flooding were discussed.

On December 15, 1987, the results of this Flood Insurance Study were reviewed and accepted at a final coordination meeting attended by representatives of the Study Contractor, FEMA, and the community.

2.0 AREA STUDIED

2.1 Scope of Study

This Flood Insurance Study covers the incorporated area of the Township of Grant, Cheboygan County, Michigan. The area of study is shown on the Vicinity Map (Figure 1).

Flooding caused by overflow of the Black River, Black Lake, and Twin Lakes was studied in detail within the community.

Approximate analyses were used to study those areas having a low development potential or minimal flood hazards.

The areas studied were selected with priority given to all known flood hazard areas and areas of projected development or proposed construction through July 1991. The scope and methods of study were proposed to and agreed upon by FEMA and the Township of Grant.

2.2 Community Description

The Township of Grant is in northeastern Cheboygan County in the extreme northern portion of lower Michigan. The community is about 10 miles southeast of the City of Cheboygan and about 28 miles southeast of the Straits of Mackinac. The Township of Grant is bordered by the Townships of Benton, Aloha, and Waverly, Cheboygan County, Michigan, on the north, west, and south, respectively, and on the east by the Township of Rearinger, Presque Isle County, Michigan.

The Township of Grant is served by Alpine State Road, Orchard Beach Road, Black River Road, and Twin Lakes Road. The 1980 population of Grant was reported to be 579, an increase from the 1970 population of 431 (Reference 1).

The predominant natural feature of the community is Black Lake, which measures about 7.5 miles by 3.5 miles and is drained by the Black River. The drainage area of the Black River at the Black Lake outlet is 597 square miles.

Less than 5 percent of the community is developed, with the remaining land either vacant or forested. Most development is along the Black River corridor and along the shoreline of Black and Twin lakes.

The climate in the Township of Grant varies from semi-marine to continental. Temperature averages range from 19.7 degrees Fahrenheit (°F) in January to 67.9 °F in July. Annual precipitation is 26.9 inches, with average annual snowfall ranging from 75 inches at the City of Cheboygan to 120 inches in the higher elevations of the Black River drainage basin. Precipitation is fairly well distributed through the year (Reference 2).

FIGURE 1

FEDERAL EMERGENCY MANAGEMENT AGENCY

TOWNSHIP OF GRANT, MI
(CHEBOYGAN CO.)

APPROXIMATE SCALE

4 0 4 8 12 MILES

VICINITY MAP

2.3 Principal Flood Problems

Major flooding in this region generally occurs in the spring due to heavy rainfall or a combination of heavy rainfall on frozen ground combined with snowmelt. Due to varying operation of the Alverno Dam, 5.6 miles downstream of Black Lake, peak discharges on the Black River are not always coincident with peak Black Lake levels. The highest recorded Black Lake level of 615 feet National Geodetic Vertical Datum of 1929 (NGVD), occurred on April 20, 1960. The corresponding river discharge was 2,500 cubic feet per second (cfs) (Reference 3). The largest recorded river flow of 2,700 cfs occurred on April 27, 1972, when the lake level was 614.26 feet NGVD (Reference 4). Records are available for the Black Lake outlet for the period 1943 to 1978.

There are no reliable records of flood elevations for Twin Lakes. However, high-water levels are almost always the result of spring rains on frozen ground accelerating the snowmelt-runoff process.

2.4 Flood Protection Measures

Alverno Dam, located 5.6 miles downstream of Black Lake, is primarily designed as a power generating unit, although normal pool elevations have been established that allow a nominal amount of storage to be used for spring runoff. An established winter pool elevation of 610.5 NGVD allows up to 1.7 feet of storage in Black Lake before the lake reaches its established summer elevation of 612.2 NGVD. That amount of storage can help alleviate some springtime flooding. For the purposes of this study, it is assumed that the dam is operated to minimize flooding during the significant floods studied.

3.0 ENGINEERING METHODS

For the flooding sources studied in detail in the community, standard hydrologic and hydraulic study methods were used to determine the flood hazard data required for this study. Flood events of a magnitude that is expected to be equaled or exceeded once on the average during any 10-, 50-, 100-, or 500-year period (recurrence interval) have been selected as having special significance for floodplain management and for flood insurance rates. These events, commonly termed the 10-, 50-, 100-, and 500-year floods, have a 10-, 2-, 1-, and 0.2-percent chance, respectively, of being equaled or exceeded during any year. Although the recurrence interval represents the long-term average period between floods of a specific magnitude, rare floods could occur at short intervals or even within the same year. The risk of experiencing a rare flood increases when periods greater than 1 year are considered. For example, the risk of having a flood that equals or exceeds the 100-year flood (1-percent chance of annual exceedence) in any 50-year period is approximately 40 percent (4 in 10), and, for any 90-year period, the risk increases to approximately 60 percent (6 in 10). The analyses reported herein reflect flooding potentials based on conditions existing in the community at the time of completion of this study. Maps and flood elevations will be amended periodically to reflect future changes.

3.1 Hydrologic Analyses

Hydrologic analyses were carried out to establish the peak discharge-frequency relationships for each riverine flooding source studied in detail affecting the community.

For the Black River, an analysis of stream gaging records for the period 1943 through 1978 was made using a standard log-Pearson Type III statistical analysis (Reference 5). The gage used was located 0.3 mile downstream of Black Lake, within the river study reach. Therefore, results were used directly, without adjustment for drainage area.

For Twin Lakes, the hydrologic analysis was performed using the U.S. Army Corps of Engineers (COE) HEC-1 computer program (Reference 6). An evaluation of soil types in the watershed (Reference 7), the time of concentration, and the storage effect of the lake were combined with a 30-day rainfall pattern for selected recurrence intervals (Reference 8), to produce the discharge flow at the outlet of Twin Lakes.

Peak discharges for the 10-, 50-, 100-, and 500-year floods of each flooding source studied in detail in the community are shown in Table 1.

TABLE 1 - SUMMARY OF DISCHARGES

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (SQ MILES)	PEAK DISCHARGE (CFS)			
		10-YEAR	50-YEAR	100-YEAR	500-YEAR
BLACK RIVER at outlet of Black Lake	597	2,350	3,000	3,250	3,850

Elevations for floods of the selected recurrence intervals of Black Lake and Twin Lakes are shown in Table 2.

TABLE 2 - SUMMARY OF ELEVATIONS

FLOODING SOURCE AND LOCATION	PEAK ELEVATION (FEET NGVD)			
	10-YEAR	50-YEAR	100-YEAR	500-YEAR
BLACK LAKE within community	614.6	615.4	615.7	616.6
TWIN LAKES within community	681.0	681.3	681.4	681.7

3.2 Hydraulic Analyses

Analyses of the hydraulic characteristics of flooding from the sources studied were carried out to provide estimates of the elevations of floods of the selected recurrence intervals.

Cross sections for the backwater analyses of the Black River and Twin Lakes outlet were obtained by field measurement in October 1985. All bridges, dams, and culverts were field surveyed to obtain elevation data and structural geometry.

Locations of selected cross sections used in the hydraulic analyses are shown on the Flood Profiles and on the Flood Insurance Rate Map.

Roughness factors (Manning's "n") used in the hydraulic computations were chosen based on field observations of the stream and floodplain areas and then calibrated on flow and elevation measurements made by the U.S. Geological Survey on April 22, 1971. Roughness values for the channel of the Black River ranged from 0.026 to 0.035 while floodplain roughness varied from 0.021 to 0.070 for all floods. Water-surface elevations of floods of selected recurrence intervals were computed using the HEC-2 step-backwater computer program (Reference 9).

Flood profiles were drawn showing the computed water-surface elevations for floods of the selected recurrence intervals. In cases where the 50- and 100-year flood elevations are close together, due to limitations of the profile scale, only the 100-year profile has been shown.

Starting water-surface elevations for the Black River were calculated using the winter pool elevation (610.5 feet NGVD) at the Alverno Dam, except for the 100- and 500-year flows, which used a rating curve developed from information supplied by the Black River Power Company and from the Dam Safety Inspection Report (Reference 10).

The hydraulic analyses for this study are based on the effects of unobstructed flow. The flood elevations shown on the profiles are thus considered valid only if hydraulic structures remain unobstructed, operate properly, and do not fail.

All elevations are referenced to NGVD. Elevation reference marks used in this study are shown on the map and described in the exhibit labeled Elevation Reference Marks.

4.0 FLOODPLAIN MANAGEMENT APPLICATIONS

The National Flood Insurance Program encourages State and local governments to adopt sound floodplain management programs. Therefore, each Flood Insurance Study provides 100-year flood elevations and delineations of the 100- and 500-year floodplain boundaries and 100-year floodway to assist communities in developing floodplain management measures.

4.1 Flood Boundaries

To provide a national standard without regional discrimination, the 1-percent annual chance (100-year) flood has been adopted by FEMA as the base flood for floodplain management purposes. The 0.2 percent annual chance (500-year) flood is employed to indicate additional areas of flood risk in the community. For each stream studied in detail, the 100- and 500-year floodplain boundaries have been delineated using the flood elevations determined at each cross section. Between cross sections, the boundaries were interpolated using aerial photogrammetric maps at scales of 1:9600 and 1:24000 (Reference 11).

The 100- and 500-year floodplain boundaries are shown on the Flood Insurance Rate Map. On this map, the 100-year floodplain boundary corresponds to the boundary of the areas of special flood hazards (Zones A, AE, AH, AO, A99, V, and VE) and the 500-year floodplain boundary corresponds to the boundary of areas of moderate flood hazards. In cases where the 100- and 500-year floodplain boundaries are close together, only the 100-year floodplain boundary has been shown. Small areas within the floodplain boundaries may lie above the flood elevations but cannot be shown due to limitations of the map scale and/or lack of detailed topographic data.

For the streams studied by approximate methods, only the 100-year floodplain boundary is shown on the Flood Insurance Rate Map.

4.2 Floodways

Encroachment on floodplains, such as structures and fill, reduces the flood-carrying capacity, increases the flood heights and velocities, and increases flood hazards in areas beyond the encroachment itself. One aspect of floodplain management involves balancing the economic gain from floodplain development against the resulting increase in flood hazard. For purposes of the National Flood Insurance Program, a floodway is used as a tool to assist local communities in this aspect of floodplain management. Under this concept, the area of the 100-year floodplain is divided into a floodway and a floodway fringe. The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 100-year flood can be carried without substantial increases in flood heights. Minimum Federal standards limit such increases to 1.0 foot, provided that hazardous velocities are not produced. In Michigan though, under Michigan Act 245, Public Acts of 1929, as amended by Act 167, Public Acts of 1968 (Reference 12), encroachment in the floodplain is limited to that which will cause only an insignificant increase in flood heights. Thus, at the recommendation of the Bureau of the Water Management, a floodway having no more than a 0.1-foot surcharge has been delineated for this study. The floodways in this study are presented to local agencies as minimum standards that can be adopted directly or that can be used as a basis for additional floodway studies.

The floodways presented in this study were computed for certain stream segments on the basis of equal conveyance reduction from each side of the floodplain. Floodway widths were computed at cross sections. Between

cross sections, the floodway boundaries were interpolated. The results of the floodway computations are tabulated for selected cross sections and are shown in Table 3, Floodway Data. The computed floodways are shown on the Flood Insurance Rate Map. In cases where the floodway and 100-year floodplain boundaries are either close together or collinear, only the floodway boundary is shown.

The area between the floodway and the 100-year floodplain boundaries is termed the floodway fringe. The floodway fringe encompasses the portion of the floodplain that could be completely obstructed without increasing the water-surface elevation of the 100-year flood more than the State's allowable surcharge at any point. Typical relationships between the floodway and the floodway fringe and their significance to floodplain development are shown in Figure 2.

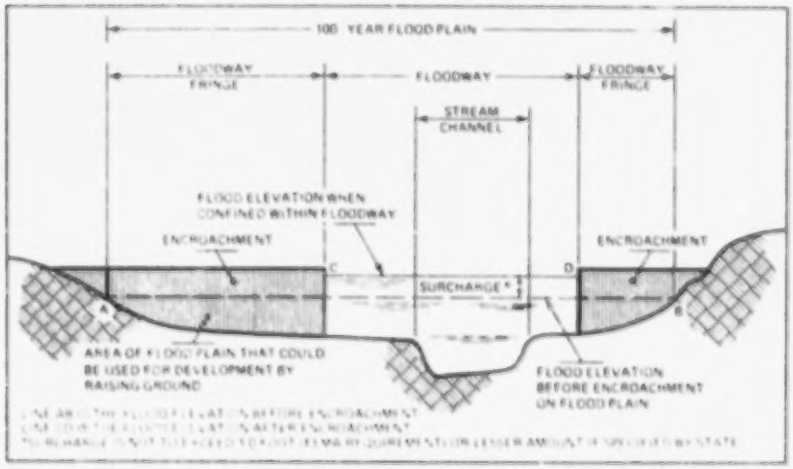

FIGURE 2 - Floodway Schematic

5.0 INSURANCE APPLICATION

For flood insurance rating purposes, flood insurance zone designations are assigned to a community based on the results of the engineering analyses. These zones are as follows:

Zone AE

Zone AE is the flood insurance rate zone that corresponds to the 100-year floodplains that are determined in the Flood Insurance Study by detailed methods. Whole-foot base flood elevations derived from the detailed hydraulic analyses are shown at selected intervals within this zone.

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQ. FEET)	MEAN VELOCITY (FEET SEC.)	REGULATORY (FEET NGVD)	WITHOUT FLOODWAY (FEET NGVD)	WITH FLOODWAY (FEET NGVD)	INCREASE (FEET)
BLACK RIVER								
A	3700	231[2]	2360	1.4	612.2	611.4[3]	611.4	0.0
B	5760	441[2]	3304	1.0	612.2	611.4[3]	611.4	0.0
C	8400	182[2]	1257	2.6	612.2	611.5[3]	611.5	0.0
D	10,540	194[2]	1157	2.8	612.2	612.0[3]	612.0	0.0
E	13,270	155	657	4.9	613.7	613.7	613.7	0.0
F	13,870	150	1193	2.7	614.5	614.5	614.5	0.0
G	13,970	158	1322	2.5	614.6	614.6	614.6	0.0
H	15,390	185	1139	2.9	614.9	614.9	614.9	0.0
I	17,270	200	1532	2.1	615.2	615.2	615.2	0.0
J	17,904	149	1558	2.1	615.2	615.2	615.3	0.1
K	19,840	400	2305	1.4	615.4	615.4	615.4	0.0
L	21,485	678	2865	1.1	615.5	615.5	615.5	0.0
M	23,500	893	4140	0.8	615.5	615.5	615.6	0.1
N	25,875	690	3432	0.9	615.6	615.6	615.6	0.0
O	28,080	1250	4984	0.7	615.6	615.6	615.7	0.1
P	29,870	1340	6079	0.5	615.7	615.7	615.7	0.0

[1]FEET ABOVE ALVERNO DAM
[2]THIS WIDTH EXTENDS BEYOND CORPORATE LIMITS
[3]ELEVATIONS WITHOUT CONSIDERING SEASONAL POOL EFFECTS

TABLE 3

FEDERAL EMERGENCY MANAGEMENT AGENCY

TOWNSHIP OF GRANT, MI
(CHEBOYGAN CO.)

FLOODWAY DATA

BLACK RIVER

Zone X

Zone X is the flood insurance rate zone that corresponds to areas outside the 100-year floodplain, areas of 100-year flooding where average depths are less than 1 foot, areas of 100-year flooding where the contributing drainage area is less than 1 square mile, and areas protected from the 100-year flood by levees. No base flood elevations or depths are shown within this zone.

6.0 FLOOD INSURANCE RATE MAP

The Flood Insurance Rate Map is designed for flood insurance and floodplain management applications.

For flood insurance applications, the map designates flood insurance rate zones as described in Section 5.0 and, in the 100-year floodplains that were studied by detailed methods, shows selected whole-foot base flood elevations or average depths. Insurance agents use the zones and base flood elevations in conjunction with information on structures and their contents to assign premium rates for flood insurance policies.

For floodplain management applications, the map shows by tints, screens, and symbols the 100- and 500-year floodplains, the floodways, and the locations of selected cross sections used in the hydraulic analyses and floodway computations.

7.0 OTHER STUDIES

The COE prepared a report on flood control for the Black River (Reference 13) in 1965 that recommended a dredging project in the area of Smiths Rapids that would deepen the channel and widen portions of the river to 100 feet. The report states that the Alverno Dam controls the lake level during periods of low flows, and Smiths Rapids controls the level during high flows of about 1,500 cfs or more. The report included an estimated 100-year elevation for Black Lake of 616.8 feet NGVD based on lake routing. The report did not, however, have the benefit of a calibrated river hydraulic model for determining the backwater effects of the dam and river. Therefore, the levels presented in this Flood Insurance Study supersede the ones presented in the COE report.

This Flood Insurance Study supersedes the previously printed Flood Hazard Boundary Map for the Township of Grant, Michigan (Reference 14).

8.0 LOCATION OF DATA

Information concerning the pertinent data used in the preparation of this study can be obtained by contacting the Natural and Technological Hazards Division, Federal FEMA, 300 South Wacker Drive, Chicago, Illinois 60606.

9.0 REFERENCES AND BIBLIOGRAPHY

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13. U.S. Army Corps of Engineers, Detroit District, Detailed Project Report on Flood Control for Black River Cheboygan County, Michigan, Detroit, Michigan, 1965.

14. U.S. Department of Housing and Urban Development, Federal Insurance Administration, Flood Hazard Boundary Map, Township of Grant, Cheboygan County, Michigan, October 1975.

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Fargo Engineering Company for Consumers Power Company, Effects of Removal of Alverno Dam, Black River, Michigan, 1968.

Stanteford, H.S., Ph.D. and G.R. Alger, Ph.D., Study of Potential for Control of Black Lake Water Levels, Hancock, Michigan, 1986.

ELEVATION REFERENCE MARKS

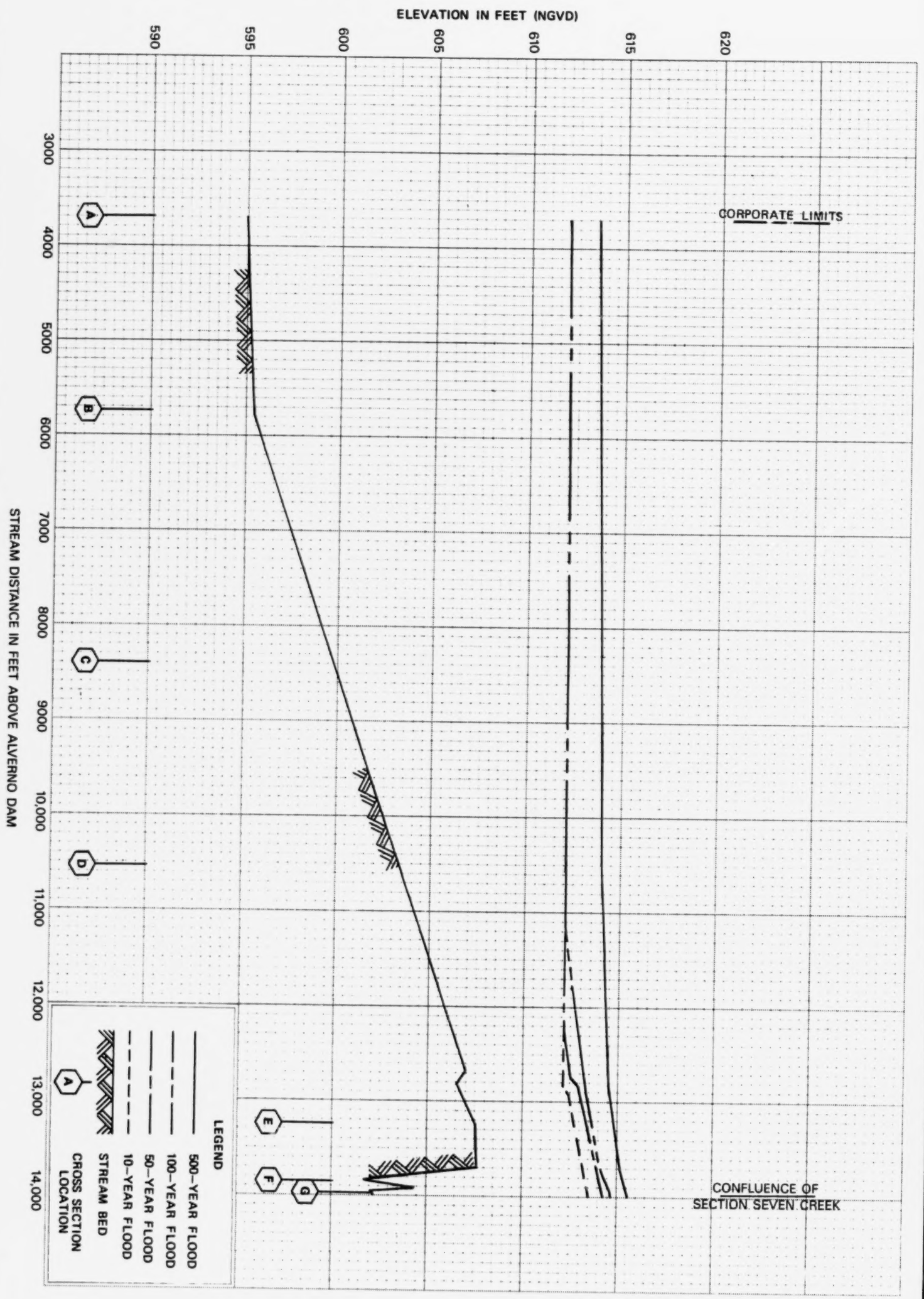
REFERENCE MARK	FLOOD INSURANCE RATE MAP PANEL	ELEVATION (FEET NGVD)	DESCRIPTION OF LOCATION
1	0015	648.85	nail in guard post in southeast corner of the intersection of Black River Road and Mann Road
2	0015	622.37	concrete base of Black Lake Marina steel post sign on Black River Road at south terminus of Abbey Road
3	0015	626.15	nail in south side of power pole on northwest side of the intersection of Abbey Road and Covington Road
4	0015	640.00	railroad spike in the center of intersection of Black River Road and north terminus of Abbey Road
5	0015	648.17	top of 24-inch diameter pipe culvert in northwest corner of intersection of South River Road and Forsyth Drive
6	0015	660.32	top of 24-inch diameter pipe culvert in northwest corner of intersection of South River Drive and Lenz Drive
7	0015	626.79	chiseled square in northeast corner of southeast wingwall of Black River Road bridge over the Black River
8	0015	641.32	top of concrete road right-of-way marker at southeast corner of intersection of Black River Road and Twin Lakes Road
9	0015	641.26	nail in southwest side of power pole in southeast corner of intersection of Black River Road and Betterly Road
10	0015	614.61	nail in east side of 3-cedar post in southwest corner of intersection of Owens Road and Kuras Drive
11	0015	618.01	nail in northwest side of power pole at southeast corner of intersection of Owens Road and Ross Road

ELEVATION REFERENCE MARKS

REFERENCE MARK	FLOOD INSURANCE RATE MAP PANEL	ELEVATION (FEET NGVD)	DESCRIPTION OF LOCATION
12	0015	635.14	nail in power pole no. MLI-130-A about 1,100 feet south of North Black River Road on Betterly Road
13	0020	708.73	nail in northeast side of telephone pole in northwest corner of intersection of Dorvia Beach Road and Twin Lake Road
14	0020	681.26	top of southeast corner at southeast wingwall of Twin Lake spillway at Truscott Road
15	0020	615.57	nail in north side of power pole in front of cabin no. 9900 in southwest corner of the intersection of Rummage Road and East Miles Road
16	0020	710.04	nail in east side of power pole in northwest corner of the intersection of Twin Lake Road and Krouse Road
17	0020	614.52	nail in north side of fence post near power pole no. BL3246A near west end of West Miles Road
18	0020	697.05	railroad spike in south side of power pole at north end near bend of Reynolds Road
19	0020	686.02	nail in south side of power pole in northeast corner of the intersection of Page Road and Truscott Road
20	0025	617.64	top of square concrete survey marker in northeast corner of intersection of Black River Road and Zolner Road
21	0025	613.83	chiseled square on west end of 24-inch concrete cross culvert 100 feet south of house No. 2318 about 0.5 mile north of Zolner Road along Black River Road
22	0025	616.77	spike in east side of power pole, 100 feet south of house no. 1200 and 45 feet west of centerline of Black River Road about 0.7 mile south of Zolner Road

ELEVATION REFERENCE MARKS

REFERENCE MARK	FLOOD INSURANCE RATE MAP PANEL	ELEVATION (FEET NGVD)	DESCRIPTION OF LOCATION
23	0030	619.97	nail in east side of power pole about 200 feet inland from Black Lake on southwest side along Eisen Trail
24	0030	625.39	nail in north side of power pole located on south side of Bluff Highway, opposite house no. 1811 about 100 feet west of Presque Isle county boundary
25	0030	626.42	chiseled square in northwest corner of southeast bridge railing post about 200 feet north of 5 Mile Point Road on Black River Road
26	0030	616.42	two spikes on west side of telephone pole 20 feet northeast of northeast corner of bridge about 900 feet north of Township of Waverly corporate limits on Black River Road



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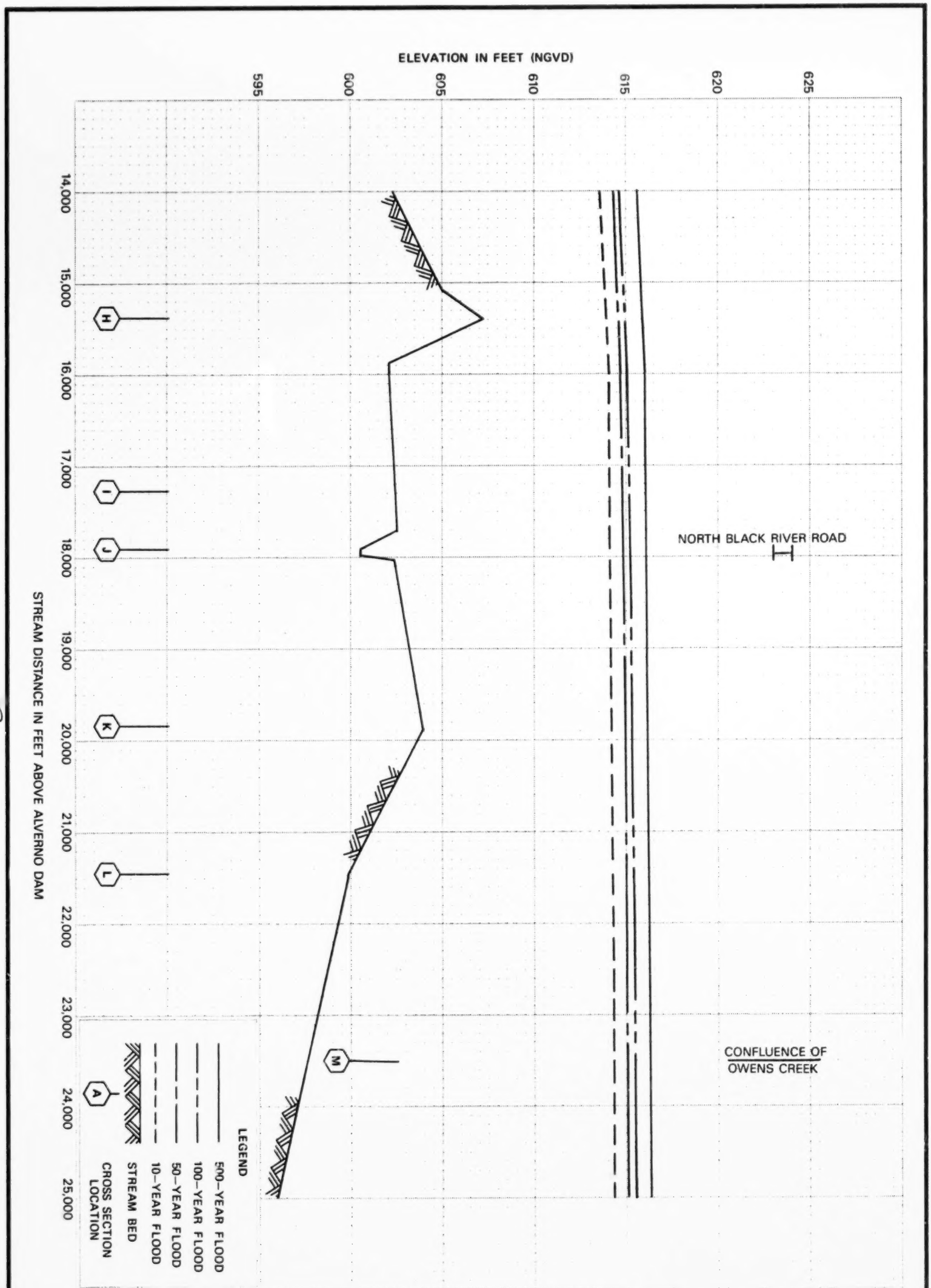
01P	FEDERAL EMERGENCY MANAGEMENT AGENCY **TOWNSHIP OF GRANT, MI** (CHEBOYGAN CO.)	**FLOOD PROFILES** **BLACK RIVER**



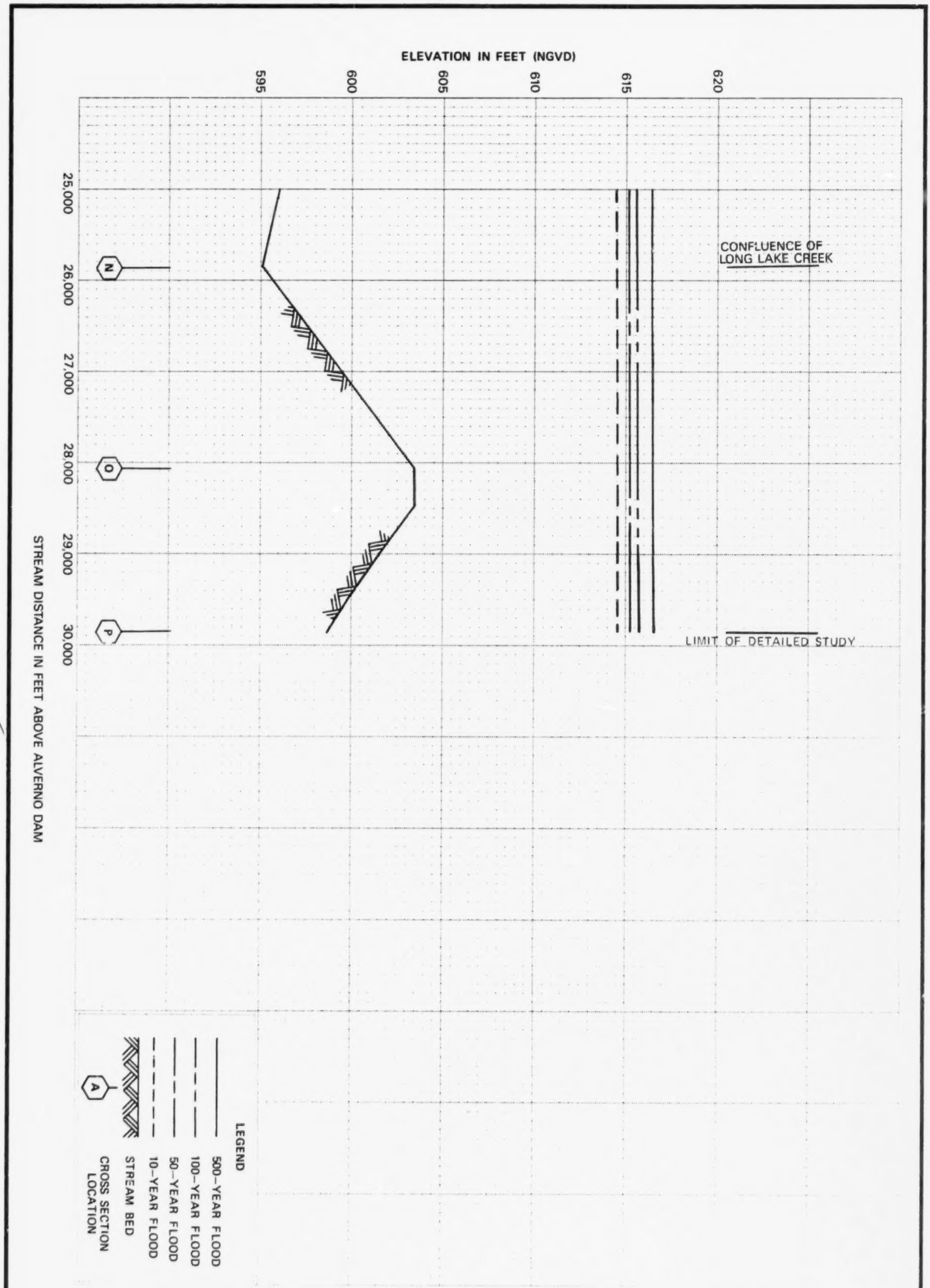
02P

FEDERAL EMERGENCY MANAGEMENT AGENCY

TOWNSHIP OF GRANT, MI
(CHEBOYGAN CO.)

FLOOD PROFILES

BLACK RIVER



03P	FEDERAL EMERGENCY MANAGEMENT AGENCY **TOWNSHIP OF GRANT, MI** (CHEBOYGAN CO.)	**FLOOD PROFILES** **BLACK RIVER**